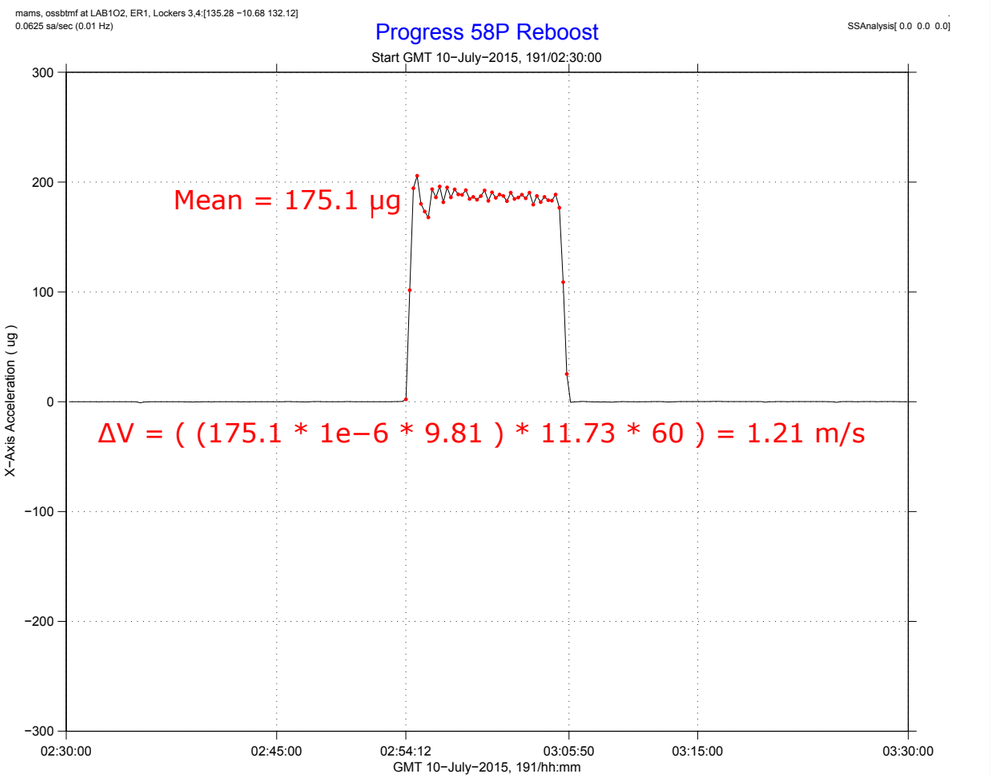
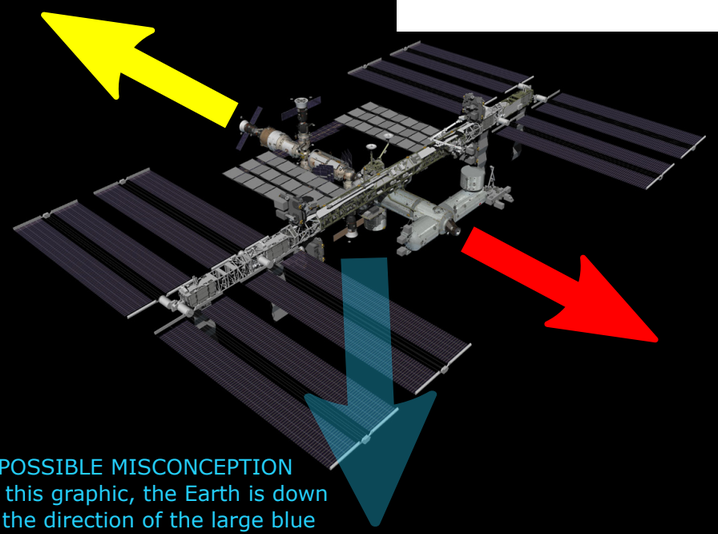
Progress Reboost Moves The Space Station

Progress Vehicle
(shown undocked)

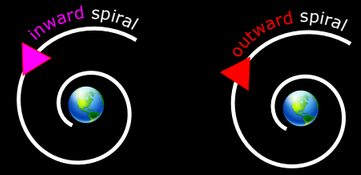
Newton's Third Law (every action has an equal and opposite reaction)
The Progress vehicle, docked to the aft end of the ISS, fires its aft-pointing thrusters to increase the space station's velocity in the forward direction thereby boosting its altitude.





A POSSIBLE MISCONCEPTION
In this graphic, the Earth is down in the direction of the large blue arrow. The misconception may be that to increase the space station's altitude above the Earth, some might think that flight controllers would fire thrusters down toward the Earth, or "push down to move up", BUT that is not the direction they fire the thrusters, it's off by 90 degrees.

TANGENTIAL ACCELERATION
The graphic on the left below shows the inward spiral associated with orbital drag, which slowly but steadily decreases the space station's altitude above the Earth.



The graphic on the right above shows the outward spiral associated with the Progress reboost, which has the net effect of increasing the space station's altitude above the Earth. Note that the spiral trajectories shown here are not to scale or accurate, those are exaggerated for emphasis.

The International Space Station (ISS) orbits the Earth at an altitude that ranges from 370 to 460 kilometers (230 to 286 miles) with an average speed of 28,000 kilometers per hour (or ~17,500 miles per hour). Owing to atmospheric drag, the ISS is constantly and gradually slowed over time. Therefore, the space station is slowly spiraling down toward the Earth. To compensate, the space station must be reboosted periodically in order to regain its desired altitude. **A Progress cargo vehicle docked at the aft end of the space station provides the primary method for reboosting the ISS.** Eight 13.3-kilograms force (or 29.3-pounds force) engines on the Progress vehicle can be used for reboosts.

The **black trace** in the plot on the left shows acceleration measurements made aboard the space station before, during, and after a reboost event. Notice that the **acceleration is usually very close to zero**, especially seen here before and after the reboost event.

The **red dot markers** show acceleration values during this **reboost period**, which had **an average value of 175.1×10^{-6} g** and **lasted about 11.73 minutes**.

The calculation shown in red (see plot) was used to derive and verify that the space station experienced a change in velocity (or **"delta V"**) of **1.21 meters per second** (or **about 2.7 miles per hour**) **in the direction of flight**.

The physics of motion dictate that an increase in velocity in the direction of flight results in an increase in the space station's altitude above the Earth, thus achieving the desired reboost.